CLAIMS

We claim:

1. A noble metal tip for use with a spark plug electrode, comprising:

a firing end having a sparking surface,

an attachment end, and;

a retention feature extending generally radially inwardly into said noble metal tip, wherein said noble metal tip is capable of being inserted into a bore located in either a spark plug center and/or ground electrode such that said sparking surface is located outside of the bore and said retention feature is located within the bore.

2. The noble metal tip of claim 1, wherein said attachment end includes a tapered section.

3. The noble metal tip of claim 1, wherein said retention feature radially extends only partially through the diameter of said noble metal tip.

4. The noble metal tip of claim 3, wherein said retention feature is of a generally conical shape.

5. The noble metal tip of claim 3, wherein said retention feature includes a groove that extends around the entire circumference of said noble metal tip.

6. The noble metal tip of claim 1, wherein said retention feature includes a diameter that is between 0.05mm-0.3mm.

7. The noble metal tip of claim 1, wherein said retention feature radially extends into said noble metal tip by a distance that is between 0.05mm-0.3mm.

8. The noble metal tip of claim 1, wherein said tip further comprises a plurality of said retention features, one or more of said features are located at a first axial position along said tip and one or more of said features are located at a second axial position along said tip, said first and second axial positions are spaced from one another.

9. The noble metal tip of claim 8, wherein first and second retention features are located at said first axial position and are circumferentially spaced from one another by approximately 180°, and third and fourth retention features are located at said second axial position and are circumferentially spaced from one another by approximately 180°.

10. The noble metal tip of claim 9, wherein said first and third retention features are circumferentially spaced by approximately 90°, said third and second retention features are circumferentially spaced by approximately 90°, said second and fourth retention features are circumferentially spaced by approximately 90°, and said fourth and first retention features are circumferentially spaced by approximately 90°.

11. The noble metal tip of claim 1, wherein said noble metal tip is comprised of an Ir-based material.

12. An electrode assembly including the noble metal tip of claim 1.

13. A spark plug including the electrode assembly of claim 12.

14. A center electrode assembly for use in a spark plug, comprising:

a center electrode component including a front end having a blind bore formed therein,

a generally cylindrical noble metal tip secured within said blind bore, said tip including:

a firing end having a sparking surface,

an attachment end located within said blind bore, and;

a retention feature, and;

a fusion layer;

wherein said retention feature receives at least a portion of said fusion layer such that said noble metal tip is secured within said blind bore.

15. The center electrode assembly of claim 14, wherein said tip further comprises a plurality of said retention features, one or more of said features are located at a first axial position along said tip and one or more of said features are located at a

second axial position along said tip, said first and second axial positions are spaced from one another.

16. The center electrode assembly of claim 14, wherein said sparking surface protrudes beyond the end of said center electrode tapered front end by a distance between 0.1mm-1.0mm.

17. The center electrode assembly of claim 14, wherein said sparking surface has a diameter between 0.25mm-1.0mm.

18. The center electrode assembly of claim 14, wherein said noble metal tip is comprised of an Ir-based material.

19. The center electrode assembly of claim 14, wherein said center electrode component is comprised of a nickel-based material having a thermal conductivity of greater than 30 W/mK during normal spark plug operating temperatures.

20. A spark plug including the center electrode assembly of claim 14.

21. A method of manufacturing a spark plug electrode assembly, said method comprising the steps of:

(a) providing a noble metal wire;

(b) providing either a center or ground electrode;

(c) drilling retention features into said noble metal wire;

(d) inserting an end of said noble metal wire into a recess in said electrode;

(e) applying a laser to said electrode such that a molten material flows into said retention features, and;

(f) cutting said noble metal wire to a predetermined length.

22. The method of claim 21, wherein step (c) further comprises using one or more laser heads to laser drill said retention features.

23. The method of claim 21, wherein step (e) involves no relative motion between said laser heads and either said electrode or said noble metal wire.

24. The method of claim 21, wherein step (c) further comprises laser drilling retention features such that they only partially extend through the diameter of said noble metal wire.

25. The method of claim 21, wherein step (f) further comprises using a tapered cutting wheel to radially cut said noble metal wire to a predetermined length such that one end of the cut section is flat where the other end of the cut section is tapered.

26. The method of claim 21, wherein said noble metal wire is an Ir-based wire.